

Patent Claims

1. Method for the modification of the optical properties of polymerisable or polymerised chiral liquid crystals, characterised in that it comprises the following steps:
 - i) application of a first layer of a polymerisable or curable chiral liquid-crystal material to a support,
 - ii) partial or complete polymerisation or curing of the first layer of the polymerisable chiral liquid-crystal material,
 - iii) application of at least one further layer of one or more extraction media to the partially or fully polymerised or cured first liquid-crystal layer, and
 - iv) where appropriate complete polymerisation or curing of the first liquid-crystal layer and/or one or more of the further layers.
2. Method according to Claim 1, characterised in that the polymerisable liquid-crystal material comprises at least one mesogenic or liquid-crystalline monomer containing at least one polymerisable group and at least one chiral compound, which is optionally polymerisable and/or mesogenic.
3. Method according to at least one of Claims 1 to 2, characterised in that the extraction medium is a solvent or solvent mixture which cannot be polymerised cationically or by means of free radicals or is unreactive to cationic or free-radical polymerisation.
4. Method according to at least one of Claims 1 to 2, characterised in that the extraction medium is a solvent or solvent mixture which can be polymerised cationically or by means of free radicals.
5. Method according to at least one of Claims 1 to 4, characterised in that the extraction medium comprises one or more solvents selected from the following groups
 - (a) nonpolar aprotic solvents, which have small dipole moments and low dielectric constants, such as hexane, benzene, toluene, carbon tetrachloride, dioxane, diethyl ether or tetrahydrofuran,

- (b) polar aprotic solvents, which have large dipole moments and high dielectric constants, such as acetone, nitrobenzene, dimethylformamide, dimethyl sulfoxide, methyl ethyl ketone (2-butanone) or ethyl acetate, and
- 5 (c) protic solvents, which contain highly polar OH or NH groups and are able to form hydrogen bonds to other molecules, such as methanol, ethanol, ethylene glycol or aniline.
- 6. Method according to at least one of Claims 1 to 5, characterised in that the extraction medium is a printing ink.
 - 10 7. Method according to at least one of Claims 1 to 6, characterised in that the extraction medium is transparent.
 - 15 8. Method according to at least one of Claims 1 to 7, characterised in that the extraction medium comprises one or more dyes and/or pigments which absorb in the visible or invisible region of the electromagnetic spectrum.
 - 20 9. Method according to Claim 8, characterised in that at least one dye and/or pigment is fluorescent.
 - 25 10. Method according to at least one of Claims 1 to 9, characterised in that the extraction medium has further functional properties in the cured state.
 - 11. Method according to Claim 10, characterised in that the functional properties are of an optical, electrical or mechanical nature.
 - 25 12. Method according to at least one of Claims 1 to 11, characterised in that the extraction medium comprises one or more mesogenic or liquid-crystalline compounds or essentially consists of this (these) compound(s), which are applied in the pure state or dissolved in a solvent.
 - 30 13. Method according to at least one of Claims 1 to 12, characterised in that the extractable constituents of the first liquid-crystal layer consist of polymerisable, but non- or only partially polymerised components.
 - 35 14. Method according to at least one of Claims 1 to 12, characterised in that the extractable constituents of the first liquid-crystal layer consist of non-polymerisable components.

15. Method according to Claim 14, characterised in that the extractable components are chiral, non-polymerisable dopants.
16. Method according to at least one of Claims 1 to 15, characterised in that the first liquid-crystal layer is applied to the support in step i) by means of a printing method or a coating method.
17. Method according to at least one of Claims 1 to 16, characterised in that at least one of the further layers in step iii) is applied by means of a printing method or a coating method.
18. Liquid-crystal film produced by a method according to at least one of the preceding claims.
19. Print product comprising one or more layers of a cured or polymerised chiral liquid-crystal material, produced by a method according to at least one of Claims 1 to 18.
20. Print product according to Claim 19, characterised in that it comprises at least one birefringent marking.
21. Print product according to Claim 19 or 20, characterised in that at least one of the layers has been applied using an ink-jet printer.
22. Print product having a print motif according to at least one of Claims 19 to 21, characterised in that
 - i) the print motif has at least one region having a first optical effect, and
 - ii) the print motif has at least one region having a second optical effect which differs from the first optical effect through a shift of the optical reflection bands towards the higher-energy region.
23. Print product according to at least one of Claims 19 to 22, characterised in that at least one of the layers has an optically variable component for the production of optical effects.
24. Print product according to at least one of Claims 19 to 23, characterised in that an optical effect is produced by the diffusion of components out of an applied medium of a first layer into another, second layer brought into contact therewith.

25. Use of a liquid-crystal film or print product according to at least one of Claims 18 to 24 as decorative element, security element, authenticity element or identification element.
- 5 26. Security feature, authenticity feature or identification feature comprising a liquid-crystal film or a print product according to at least one of Claims 18 to 24.
- 10 27. Identity document, banknote, security document, ink-transfer film, reflective film or optical data carrier provided with a liquid-crystal film or print product according to at least one of Claims 18 to 24.

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